Space Apps Chile
Asteroid Hunting - Team Tuor

The Challenge

Develop a mission concept to explore Apophis (or any other significant asteroid) to better predict its orbital dynamics and to instrument the object with a radio transponder prior to the 2029 close approach.

Team 10: Tuor

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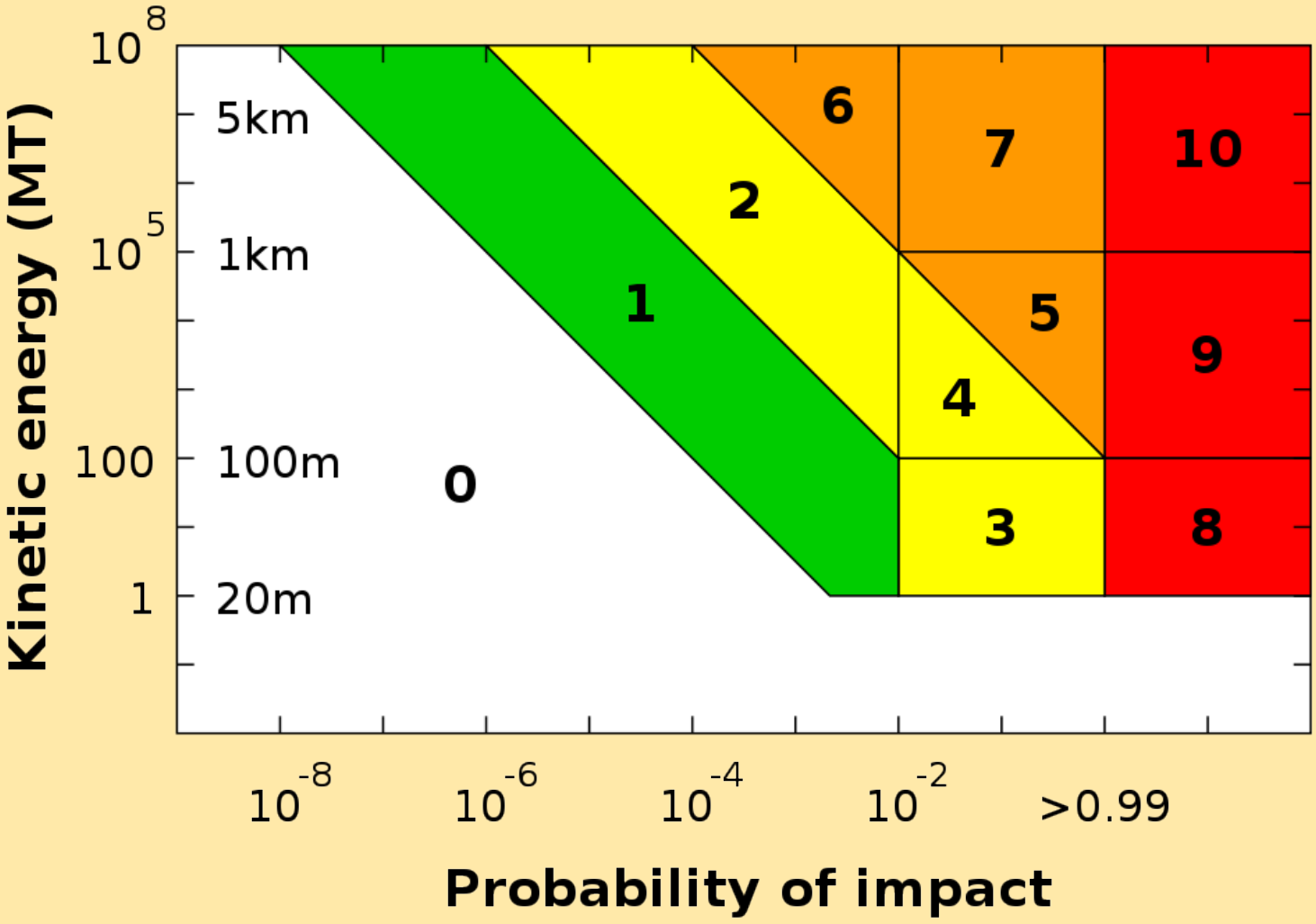
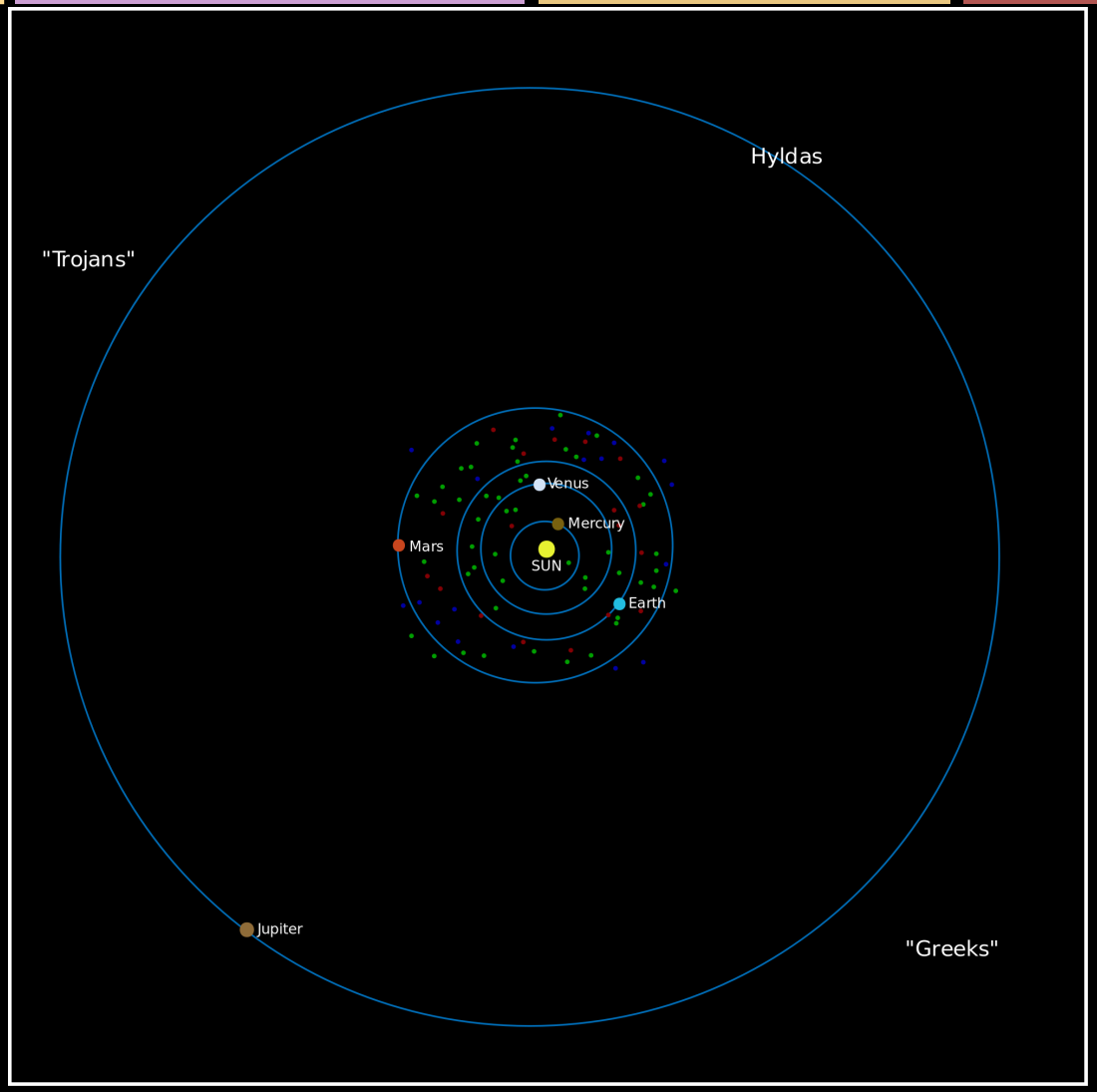
The Torino Scale: Risk assessment



Ideas, Details

- Tagging and tracking of only one asteroid (this challenge) does not make sense when there are >100.000 unknown objects in the asteroid belt that potentially can pose a risk to life on earth and require to be tracked.
- For a better orbit prediction it is required to know the forces that act on an asteroid.
- To calculate these forces, position and velocity vector of each of the objects need to be obtained
- Learning from the concept of WISE (NASA mission from 2010/2011, and continuing the observations.

The Situation:
A daunting Challenge



The Situation:
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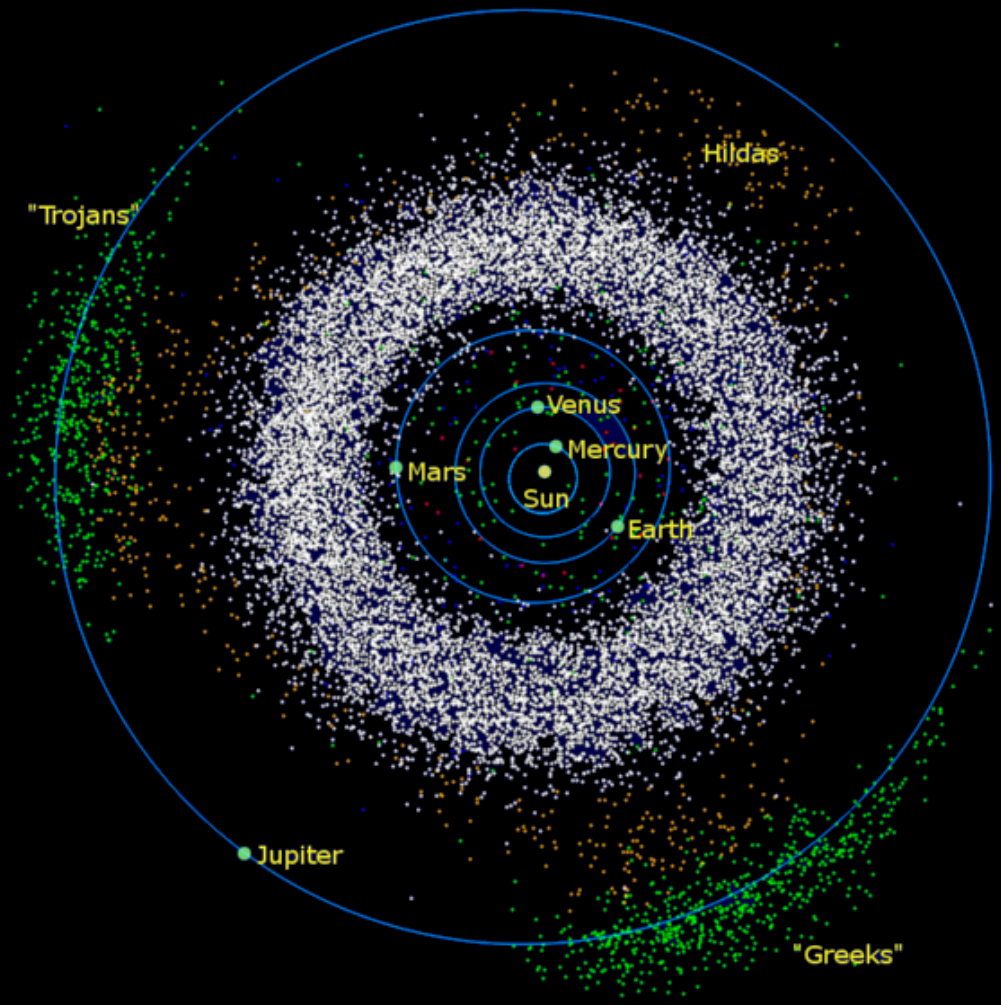


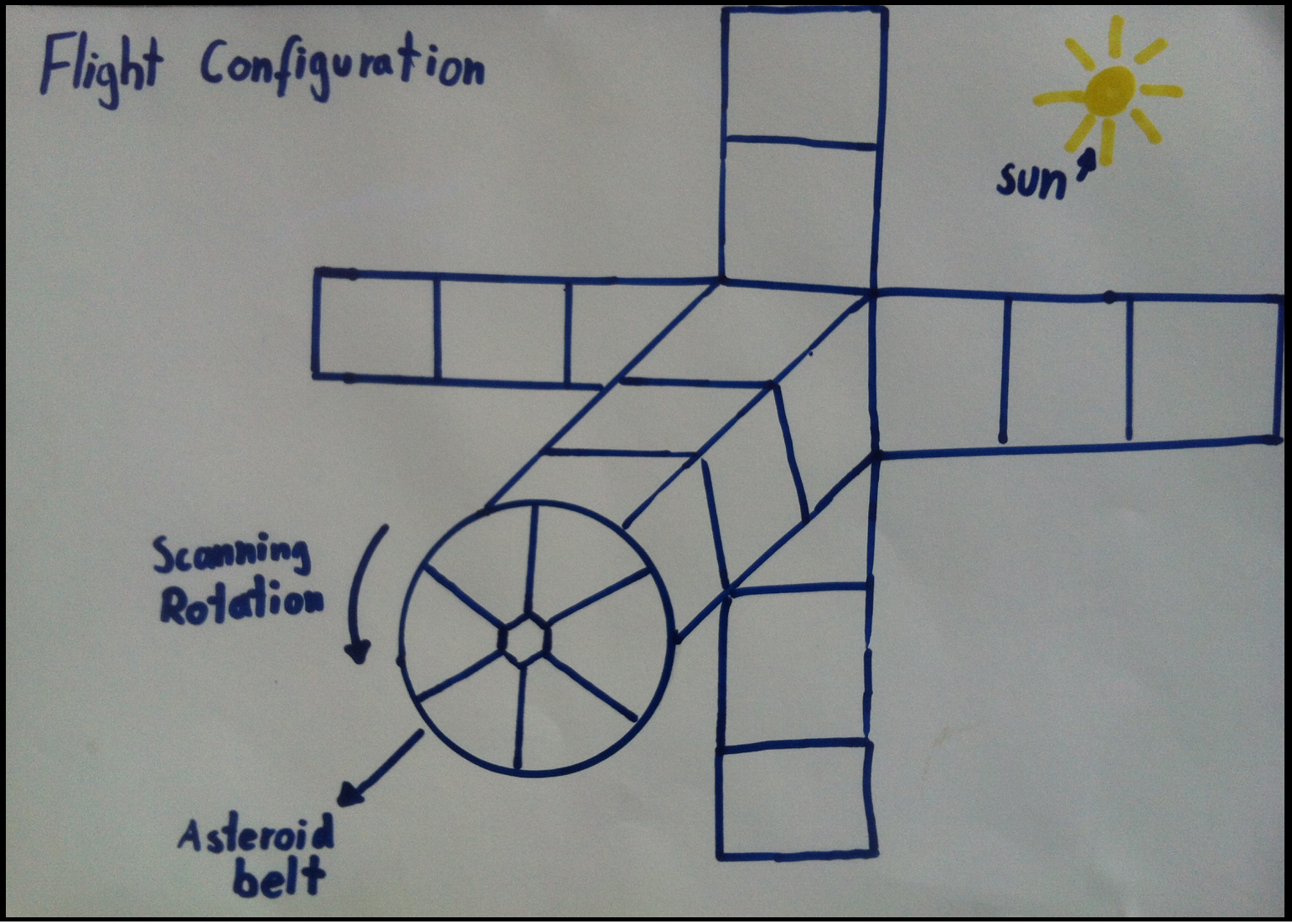
Interplanetary Mission Description Platform

- Lagrange-2 orbit at Mars: Half way to the Main Asteroid Belt (4x more signal!)
- CubeSat (Ardusat!) platform, 3U form factor
- Hitching a ride to Mars (~150kg ballast load)
- Swarm (“enjambre”) de >4 replicas
- Miniaturized ion thrusters for propulsion from Mars to L2@Mars, and attitude control
- Power from solar panels
- Telemetry/downlink via amplified CubeSat system

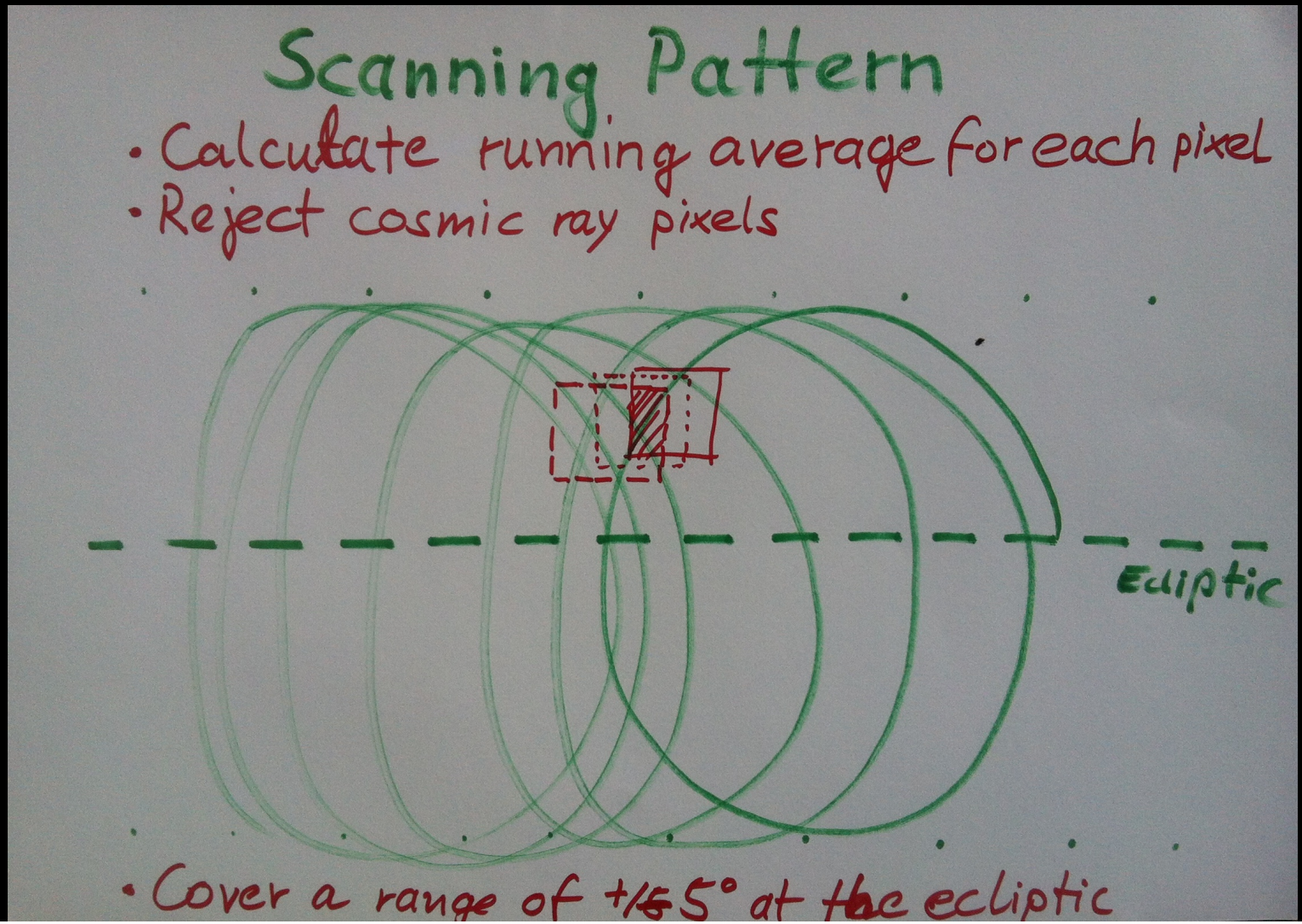
Interplanetary Mission Description
Scientific Equipment

- Rotation-cone-scanning thermal IR telescope
- 3x cell-phone CCD as star trackers
- Linux on-board processing of images (“stacking”) and data reduction
- 200mm space-foldable telescope
- 11 and 19 arcsec resolution
- 2x Peltier-cooled microbolometer arrays
- 10μm and 18μm color channels: main emission wavelength of asteroids

Flight Configuration



Scanning Geometry



Interplanetary Mission Description Results

- Download through amateur deep space network
- Post-processing at earth-bound facilities:
  - Checking of data quality
  - Incentive optical follow-up observations (validation)
  - Ingest orbital parameters of found asteroids into JPL database
  - Calculate proximity values to Earth orbit
- Visualization via web-based access to database

Synergies with other Space Apps Challenges

- Database for NEO (Near Earth Objects): **#NEOdatabase**
- CubeSats for Asteroid Exploration: **#cubesats**
- Ardusat: **#ardusat**
- Hitch a ride to Mars: **#ridetomars**
- Why We Explore: **#whyweexplore**